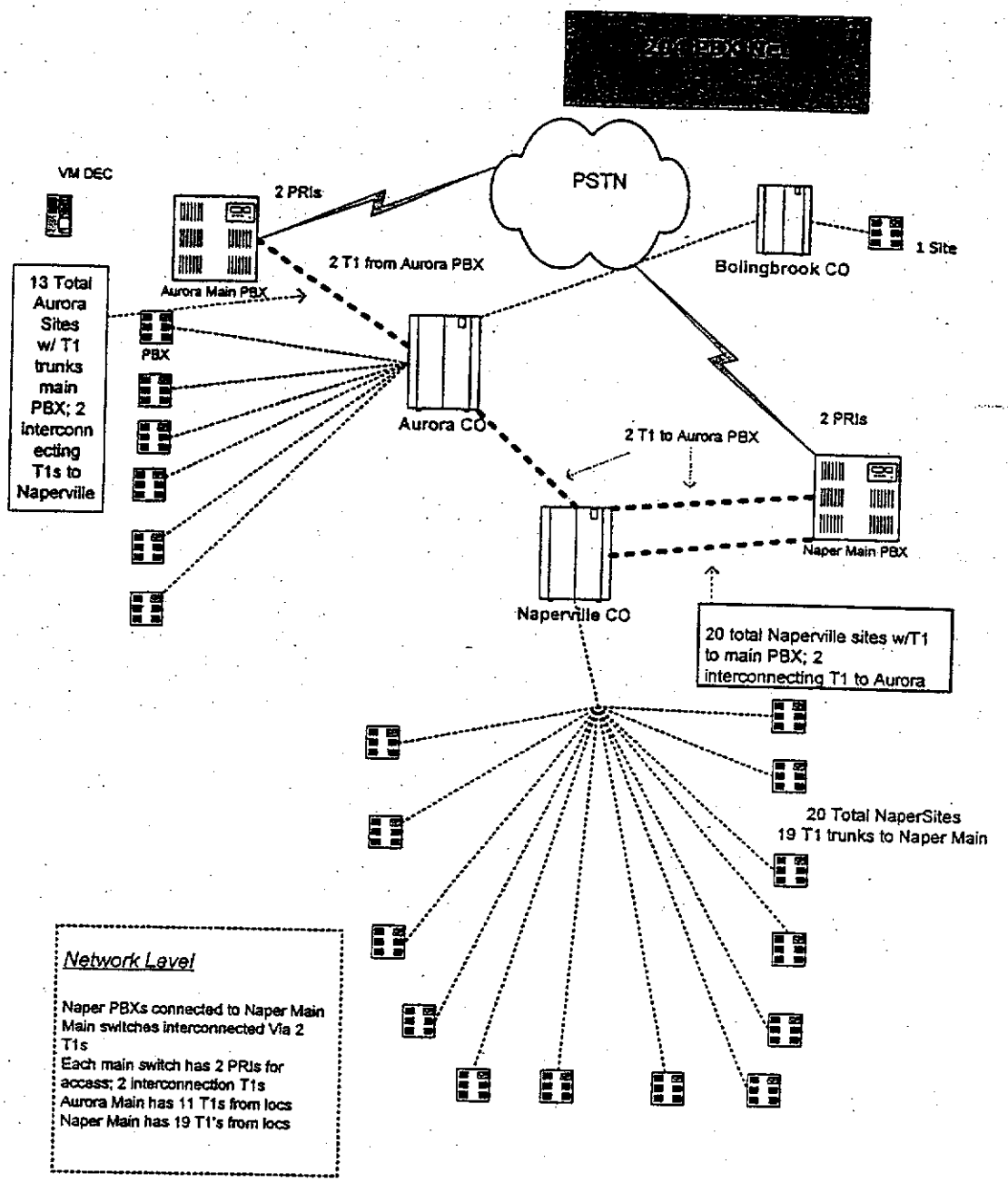

VM DEC
2 PRIs
PSTN
Bolingbrook CO
1 Site
2 T1 from Aurora PBX
Aurora Main PBX
13 Total Aurora Sites w/ T1 trunks main PBX; 2 interconn ecting T1s to Naperville
PBX
Aurora CO
2 PRIs
2 T1 to Aurora PBX
Naper Main PBX
Naperville CO
20 total Naperville sites w/T1 to main PBX; 2 interconnecting T1 to Aurora
20 Total NaperSites
19 T1 trunks to Naper Main
Network Level
Naper PBXs connected to Naper Main
Main switches interconnected Via 2 T1s
Each main switch has 2 PRIs for access; 2 interconnection T1s
Aurora Main has 11 T1s from locs
Naper Main has 19 T1's from locs

Pricing elements

The following chart details the costs for SD 204. The PBXs include all networking hardware and software to accommodate the stations detailed above. All new station sets were included. A aggregate purchase amount was developed, and costs amortized over 7 years. The network costs include T1s from SBC at the 60 month ICN rate. Maintenance was included for 5 years.

Traditional PBX Cost			
	Quantity	Cost	Total
Elementary Schools	22	43,900	965,800
MS	6	53,000	318,000
AHS	1	53,000	53,000
Fresh Campus	2	53,000	106,000
WVHS	1	151,750	151,750
NVHS Hub	1	255,500	255,500
DEC Hub	1	221,000	221,000
Buildings & Grounds	1	35,000	35,000
Total	35		2,106,050

Assuming that the district would finance the purchase of this equipment, a 7 year loan on 2,021,800 @ 3.75% would create a monthly payment of 28,545 for the equipment.

The network costs to support this configuration are as follows:

Traditional PBX Networking Cost			
		Monthly Unit Cos	Month Cost
PRI Circuits	5	600	3,000
Interconnect T1	2	196	392
T1's to Aurora hub	10	196	1,960
T1 to Naper hub	19	196	3,724
POTS back up	74	17	1,258
Total			10,334

The annual costs are

SD 204 Total Monthly Costs	
Monthly CPE	28,545
Monthly Network	10,334
Total	38,879
Annual Cost	466,548
Maintenance yr 6 &	157,954

The annual costs of $465,000 compares to a Centrex cost of $418,000.

Total monthly cost

SD 204 Total Monthly Cost	
Monthly CPE	28,545
Monthly Network	10,334
Total	38,879
Annual Cost	466,548
Maintenance yr 6 &	157,954

The monthly cost of a PBX solution is more expensive than a Centrex alternative, but not by a wide margin. It would be expected that a formal procurement would have downward pressure on both figures.

203 in a PBX mode overview

The configuration for SD 203 would also be a series of interconnected PBXs. One main hub would provide access for all locations. The assumption is that PSAC would be the hub. Either high school could also be designated as hub. Two PRIs would terminate in the hub PBX and provide access to all other locations. Actual counts were considered in determining the size. Three major issues would need to be resolved through further analysis: should two switches be used for network access (a PRI at North, another at PSAC or Central/PSAC), thereby providing better back-up in the event of a problem? Should a single switch serve both Central and PSAC, or should they be separate?? For purposes of this analysis, we are assuming separate switches. The following was used:

- Elementary schools: 15 analog stations; 5 digital stations; and 2 back-up POTS lines terminated in the switch (14 schools)
- JHS, freshman campuses: 35 analog stations; 15 digital stations; and 2 back-up POTS lines.
- North High School: 165 analog stations; 35 digital stations; and 4 back-up POTS lines terminated in the switch
- Central HS: 165 analog stations; 35 digital stations; and 4 back-up POTS lines terminated in the switch
- PSAC: 2 PRI; 20 T1s to schools; 75 digital stations and 4 back-up POTS.

Each PBX would have a T1 circuit to the main switch. It would carry all traffic, intra-district and PSTN. PSTN traffic would go out over the PRIs. Voice messaging would be centralized and all traffic originating or terminating on the other hub would be carried over these lines. All users would have DID numbers.

The following is the cost estimate:

Traditional PBX Cost			
	Quantity	Cost	Total
Elementary Schools	14	25,500	357,000
JHS	5	40,500	202,500
North	1	103,000	103,000
Central/PSAC	1	279,500	279,500
Total	21		942,000

Assuming that the district would finance the purchase of this equipment, a 7 year loan on 942,000 @ 3.75% would create a monthly payment of 12,767 for the equipment.

The network costs to support this configuration are as follows:

Traditional PBX Networking Cost			
		Monthly Unit Cos	Month Cost
PRI Circuits	2	600	1,200
T1's to hub	20	196	3,920
POTS back up	46	17	782
Total			5,902

Total monthly cost

SD203 Total Monthly Costs	
Monthly CPE	12,767
Monthly Network	5,902
Total	18,669
Annual Cost	224,028
Maintenance yr 6 &	70,650

The monthly cost of a PBX solution is more expensive than a Centrex alternative. The total monthly cost of 18,669 compares to an estimated 12,600 in a Centrex mode. If the district were to deploy phones in all the classrooms, that margin would narrow because each phone deployed would result in another Centrex line, but in the PBX solution it would merely be another extension with no monthly charge. It would be expected that a formal procurement would have downward pressure on both figures. The monthly total of 12,767 includes 985 lines plus the digital trunk serving PSAC.

It should be noted that the cost per station of a PBX solution is quite high for SD203. this is true, in part, because of the relatively few stations in each switch, coupled with the network hardware in each switch.

The City in a PBX mode overview

The configuration for the City would be a series of interconnected PBXs, or survivable portions of a single PBX, located in the major facilities of the City. The number of switches is not particularly important, providing connectivity can be provided at a distance limitation of 3-miles or less. Switch location could be connected to each other via the private network, and connected to the Public Switched Telephone Network (PSTN) via the SBC office in Naperville. The PSTN connections would be primarily ISDN Primary Rate Interface circuits providing for shared Direct-In-Dial (DID) and Direct-Out-Dial (DOD) services within the same digital circuits. Using the private network, and several PSTN access/egress points, the configuration could be made highly reliable, the only single point of failure being the SBC Naperville Central Office.

In a PBX environment, several factors must be added to the analysis. Digital trunking - to link the system to the PSTN – was already mentioned. Also, the city would likely move to mostly digital telephone stations to replace the existing Meridian key systems and the ISDN sets. The city will also have the cost of the network linking all of its facilities. The following PBX cost estimates are based on:

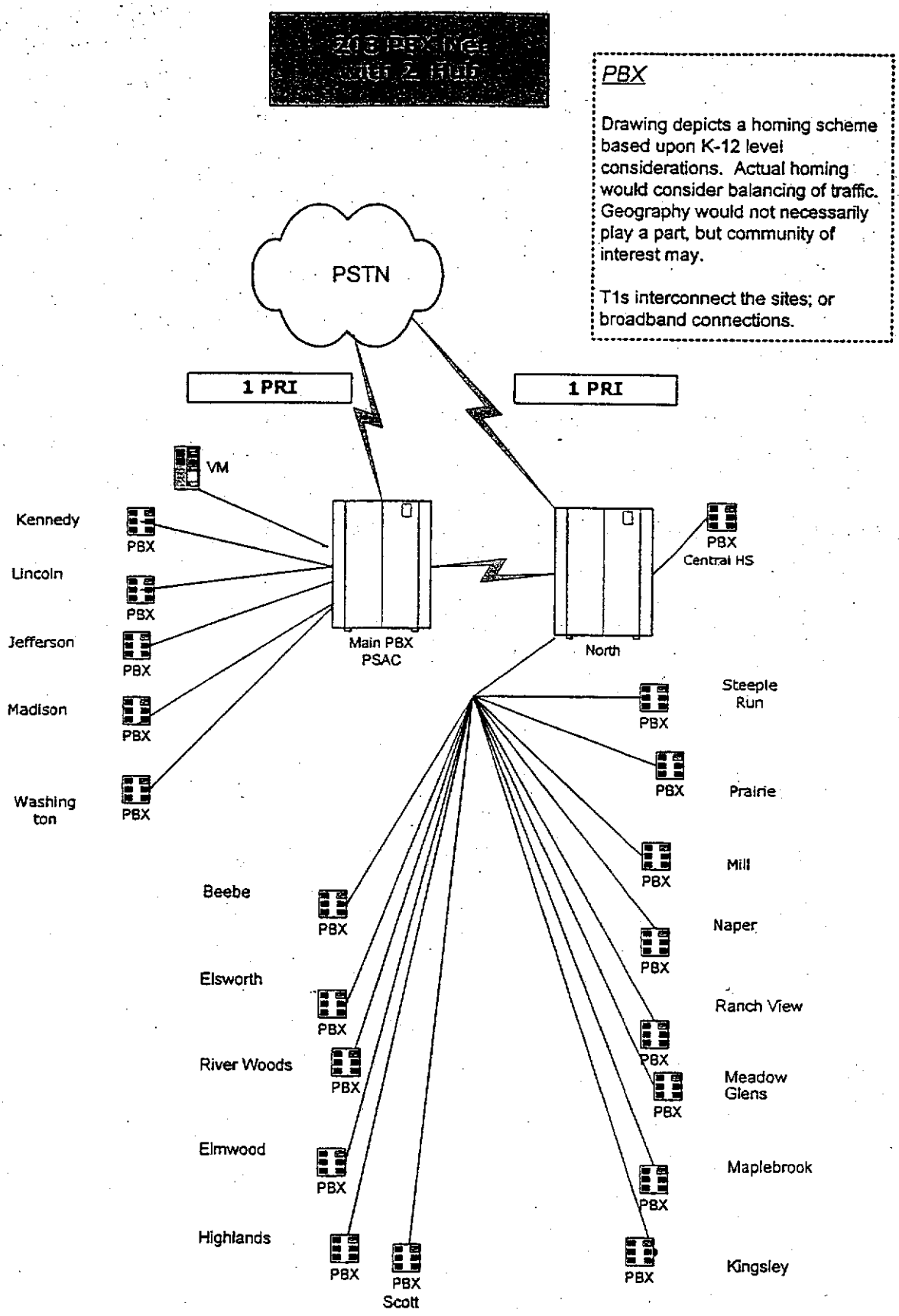
- An analog PBX station line purchase cost of $300;
- A digital PBX station line purchase cost of $300;
- An average cost of digital telephone at $200;
- A 5% annual growth rate of station lines; and,
- 230 digital trunks.

The following chart details are estimate of the purchase costs for a PBX system:

[illegible]	Quantity	Cost/Unit	Total Cost
Digital Line	1,300	$ 300	$ 390,000
Analog Line	160	$ 300	$ 48,000
Digital Telephone	1,300	$ 200	$ 260,000
ACD System	1	$ 100,000	$ 100,000
Voice Mail System	1	$ 75,000	$ 75,000
Total			**$ 873,000**

In order to compare the purchased PBX system to the Centrex system, the cost of maintenance, after the first year, and the cost of local access to the PSTN, should be added to cost of paying for the PBX purchase price over a period of years. For this example we have estimated:

- A 7-year lease of the PBX equipment and software at an interest rate of 3.75%, which yields a month payment factor of 1.3654% of the initial purchase price.
- A monthly maintenance factor of 0.5% of the initial purchase price. It is important to remember that the purchase cost includes a 12-month warranty, so the maintenance cost is applicable to Year 2 and beyond.
- A monthly access cost for ten (10) PRI circuits at $600 per circuit.


PBX
Drawing depicts a homing scheme based upon K-12 level considerations. Actual homing would consider balancing of traffic. Geography would not necessarily play a part, but community of interest may.
T1s interconnect the sites; or broadband connections.
PSTN
1 PRI
1 PRI
VM
Kennedy
PBX
Lincoln
PBX
Jefferson
PBX
Madison
PBX
Washing ton
PBX
Main PBX PSAC
North
PBX Central HS
Steeple Run
PBX
PBX
Prairie
Mill
PBX
Naper
PBX
Ranch View
PBX
Meadow Glens
PBX
Maplebrook
PBX
Kingsley
PBX
Beebe
PBX
Elsworth
PBX
River Woods
PBX
Elmwood
PBX
Highlands
PBX
PBX Scott

The City in a PBX mode overview

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Total			**$ 873,000**

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- A monthly maintenance factor of 0.5% of the initial purchase price. It is important to remember that the purchase cost includes a 12-month warranty, so the maintenance cost is applicable to Year 2 and beyond.
- A monthly access cost for ten (10) PRI circuits at $600 per circuit.

The table below summarizes the monthly PBX costs under an equipment lease scenario:

	Monthly Cost
Equipment	$ 11,920
Maintenance	$ 4,365
Access	$ 6,000
Total	**$ 22,285**

Park District Considerations

The Park District recently completed an extensive review of their services. That analysis resulted in a thoroughly modern Centrex system to serve the Park District's needs. The PD's Centrex includes extensive ISDN for voice from the Naperville CO, as well as electronic key service to Naperbrook from the Bolingbrook CO. The District has implemented E911 service. Given the nature of the Park District's deployment (many small sites), and the investment that has been made in both ISDN & EKTS equipment, a move to deploy PBXs would not be cost effective.

Library Considerations

The Library has recently decided to purchase and deploy PBXs to the three main sites. Contracts are in-place or about to be signed. Mitel switches will be interconnected to Nichols, which serves as the main hub. PRI will be used for access, with back-up analog trunks at all switches.

Voice over IP

Background and History

Over the last several years, the manufacturers and developers of data network servers and routers have participated in the development of technology to carry voice over the same networks, and using much the same network hardware and software elements, as are used to carry data information. The use of the Local Area Network (LAN) and Wide Area Network (WAN) hardware and software to effectively carry voice traffic – widely referred to as Voice over Internet Protocol (VoIP) – offers the potential for significant efficiency and cost-effectiveness in overall networking. This technology has been generally available for the last 18-24 months. While still not fully mature, VoIP systems will have significant impact on voice telephony over the next several years, as the convergence of voice and data technologies offer enormous promise to all users.

Features & Functions

VoIP systems offer an interesting feature / function comparison with traditional PBX systems. The VoIP systems offer a number of new features, unavailable on traditional PBX systems – for example, PC plug compatibility, the capability of re-locating a telephone without any hardware or software changes. Yet these same systems lack, or have extremely limited capability to provide, some of the traditional PBX features and functions. For instance, the VoIP systems are very inefficient in the use of traditional analog lines, even for purposes such as fax machines, and have serious deficiencies in the area of 9-1-1 notification to Public Access Safety Providers (PSAP). In general terms, VoIP systems offer some unique feature applications, but lack the overall feature robustness of traditional PBX systems.

Functionally, VoIP systems offer interesting management synergies. Technologically there is little difference between a VoIP server that provides for call management and a LAN server that provides data connectivity for PCs. The power of VoIP is that voice is now treated exactly as data has been treated for the last 7-10 years. Therefore, the same personnel and systems that support today's data systems are available to support and troubleshoot the VoIP systems. These management synergies potentially could be very powerful. However, it is important to remember that while the skill levels required to support the voice and data are identical, the staffing hours required to support the voice applications tend to be consistent, regardless of the system implemented.

Costs

The following Internet Telephony Protocol cost estimate is based on the following:

- No analog telephone station lines (cost variance is minimal);
- A digital line purchase cost of $300;
- An average cost of digital telephone at $300;
- Appropriate PRI circuits to meet access requirements of the entities
- Analog lines (POTS) for back-up at each building in the school districts

- A network infrastructure is in-place and supporting other applications
- Station counts were consistent with other PBX models

	Number of Stations	Equipment Cost	Annual Net Cost	Annual Maintenance
SD 204	3,240	1,944,000	51,480	174,960
SD 203	1,040	624,000	28,008	56,160
City	1,460	876,000	72,000	78,840
Park District	N/A	N/A	N/A	N/A
Library	N/A	N/A	N/A	N/A

Annual Cost

SD 204

SD 204 IP Total Monthly Costs	
Monthly CPE	26,349
Monthly Network	4,290
Subtotal	30,639
Month Maintenance yrs 2-7	14,580
Total Monthly	45,219
Annual	542,628

SD 203

SD 203 IP Total Monthly Costs	
Monthly CPE	8,457
Monthly Network	2,334
Subtotal	10,791
Month Maintenance yrs 2-7	4,680
Total Monthly	15,471
Annual	185,652

City of Naperville

City IP Total Monthly Costs	
Monthly CPE	11,873
Monthly Network	6,000
Subtotal	17,873
Month Maintenance yrs 2-7	6,570
Total Monthly	24,443
Annual	293,316

Side by side comparison of major options

	New Centrex Annual	New PBX Annual	VoIP
City	170,400	267,420	293,316
SD 203	148,830	224,028	185,652
SD 204	418,314	466,548	542,628
Park District	N/A	N/A	N/A
Library	N/A	N/A	N/A

In any comparison of major telecommunications options, it is important to note the impact of ERate funding. ERate rebates are available for that vast majority of costs related to Centrex service while customer owned PBX and IP telephony services have not proven to be ERate eligible.

If the City became a CLEC, IP telephony services could be packaged by the City as an "IP Centrex" type offering. In this scenario, voice services, including voice mail would be provided by the City as a Service Provider (CLEC) to the other organizations. Local dial tone for backup and 911 would be the responsibility of the individual organization. This appears to be defensible, but has not been tested through an ERate filing.

III. Data Network Services and Internet Access in a Naperville Community Network

The following section summarizes costs for a Naperville Community Network that is based leveraging the existing Public Works Department – Electric duct bank system and existing fiber (where available).

Assumptions

In order to develop functional cost models that project expenses for several years, we developed a series of assumptions. Whenever possible, we validated the assumptions with the appropriate authority. Additional design assumptions were developed for various portions of the Feasibility Study, these will be documented with that portion of the Study.

Bandwidth for Internet Access will grow at a combined 30% annual rate. This is a much slower rate than some organizations have experienced recently, current growth rates can not be sustained over long periods of time.

Current Illinois Century Network internet access pricing will continue as contracted.

Staffing at each organization will remain static, all Naperville Community Network design, implementation and operational tasks will need to be performed with external resources.

The current construction plans for the Naperville Public Utilities infrastructure will continue as forecast.

City duct bank installation will continue as planned by the Department of Public Utilities. The following table summarizes the current duct bank installation schedule.

Facility	Status	Scheduled Budget for Complete
Municipal Center (1 LAN)	Complete	
Police Dept./Fire Admin Fire St.#7	Complete	
Electric Service Center	Complete	
Water Tower West	Complete	
Water Service Center (2 Buildings)		04/05
CEECM & Springbrook (2 bldg w/fibr)		04/05
Fire Station #1	Complete	
Fire Station #2		04/05

Fire Station #3	Complete	
Fire Station #4		04/05
Fire Station #5		04/05
Fire Station #6		04/05
Fire Station #8 & Clyde (2 Bldgs)	Complete	
Municipal Center (1 LAN)	Complete	
Police Dept./Fire Admin Fire St.#7	Complete	

Background

The Naperville Park District, Naperville School District 203 and Indian Prairie School District 203 currently maintain separate data networks. The City of Naperville and the Naperville Public Library System share a data network that inter-connects all their facilities. The City and Public Library each maintain their own internet access.

The characteristics of the school district and library networks are different from the Park District and City. The library network is primarily used for internet access. The School District networks are split evenly between internet access usage and internal networking. The Park District and the City primarily use their networks to access internal systems, internet access is a much lower percentage of total volume.

Currently, none of the organizations involved in the Study use the network to transport significant amounts of video traffic, although all the organizations expresses a desire to use video for applications including video surveillance, video conferencing, distance learning, internet video activities and training.

None of the organizations involved in the Study use the data network to transport voice traffic. Although School District 203 has a pilot Voice over IP system installed in an elementary school.

Naperville Park District

The Park District network consists of 11Mb wireless links between the Park District buildings that are located on the north side of the river. The more remote locations are connected by T1s with the Park District Headquarters as the hub for the T1s. Internet access is provided through a T1 connected to Park District Headquarters.

Currently, the Park District has sufficient bandwidth to meet it's needs. The Park District has purchased two additional buildings in the area that they are planning to connect to the network using wireless access points.

Naperville Public Library

The two existing Naperville Public Library locations are connected through the FDDI ring that the City of Naperville leases from AT&T Comcast. Each Library maintains a

separate T1 based internet connection. The Library plans to add a second T1 of internet access at the Nichols facility.

The Naperville Public Library is in the process of constructing a new building on 95th Street. This building will be connected to the other buildings by a 1Gb fiber optic connection to the City of Naperville network. The Library plans to implement two T1s for internet access at the new facility.

City of Naperville

The majority of City locations are interconnected through the 100Mb FDDI ring that is currently provided through AT&T Comcast. The FDDI ring connects Municipal Center and 16 outlying locations. Some City locations, including the Municipal Center, Public Works and Police and Fire Administration are connected through City owned fiber optic links that operate at 1Gbps. Implementing a Gbps fiber optic network to replace the existing FDDI ring is under consideration for all City locations .

The City is connected to the internet through a single T1. A backup internet connection is desired as a result of the TOP exercise that was held recently.

Naperville CUSD 203

All Naperville CUSD 203 school locations are connected through T1s to the Administrative Center in a star configuration. The Administrative Center has a T3 connection to the internet. Currently, peak internet traffic is 7Mb to 8Mb, equivalent to approximately five (5) T1s of bandwidth.

District 203 is experiencing bandwidth shortages between the Administrative Center and the two High Schools and will be experiencing bandwidth shortages between the Administrative Center and the Junior Highs in the near term.

Indian Prairie CUSD 204

Indian Prairie CUSD 203 schools are inter-connected through a web of 11Mb wireless connections. These connections are configured in a circular manner, each connection to an adjacent school is based on the availability of line of site. Each school has two connections, providing alternative paths in the event of a failure of any specific link. In general, the High Schools act as collection points for the other schools and forward data network traffic on to the PSAC.

Indian Prairie 204 recently installed separate 100Mbps wireless links between the PSAC and each High School. These links serve as the primary traffic consolidation points between the remaining schools and PSAC. Each of these 100 Mb links are currently reaching a peak utilization of between twelve (12) and fourteen (14) Mb of bandwidth.

Indian Prairie 204 maintains approximately 9Mb of internet bandwidth through six (6) T1s to ICN. These six (6) T1s are fully utilized at peak times. The District is considering expanding the amount of internet bandwidth available to approximately 20Mb. Purchase of a DS-3 (45Mb) of bandwidth would be the districts optimal solution.

Proposed Network

For this feasibility study we propose that each location be provided with a fiber optic termination point. This termination point will contain a patch panel with 12 strands of single mode fiber. We propose that the organization will be responsible for providing the electronics within the facility that connects to the Naperville Community Network.

A termination point will be1Gb or more, depending on the the need for higher speed connections between the collection points and the core network. Each termination point will be connected to a Layer 3 switch that will be owned and administered by the Naperville Community Network project. For each organization, a separate VLAN will be configured. The VLAN will provide security through a completely separate virtual network for that organization.

The VLAN will encompass all of the organizations locations and include a separate "DMZ" at the point of internet connectivity. The "DMZ" will provide a location for any internet/web site screening software that may be utilized by the organization. Also at the point of internet connectivity will be a firewall. The firewall will be administered centrally to assure overall security meets a high standard. Because each organization will be on a separate VLAN, firewall configuration settings can be customized by organization.

After evaluating several alternatives, the most cost effective high bandwidth, high reliability solution for the Naperville Community Network is a fiber optical ethernet network with concentration points for all facilities at key City owned locations.

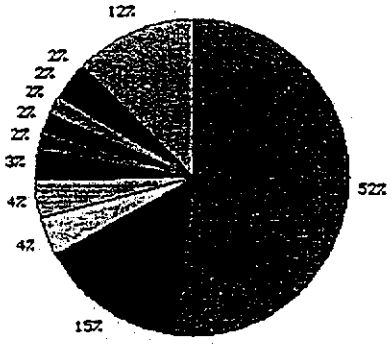
For this Study, we determined that City of Naperville Fire Stations we the best collection points. The Fire Stations are geographically dispersed to minimize fiber optic cabling distances. They are staffed 24 hours a day, seven days per week and the staff is security conscious. We priced three alternative cost structures for this study.

The first alternative priced was a SONET based network that the Fire Station Collection Points in a redundant ring configuration. All other locations would connect to a Fire Station Collection point through either a 100Mb or a 1Gb fiber optic connection.

Internet Access Bandwidth Usage

Some initial results from District 204 show that internet bandwidth usage is approximately 50% of overall bandwidth utilization. This is shown in the below graph that classifies bandwidth utilization by type.

Top 10 Classes



Class Name	Average Rate (bps)	(%)
1. /Inbound/Waubonsie/HTTP	211k	52
2. /Inbound/Hill/Default	59.1k	15
3. /Inbound/SSL	15.9k	4
4. /Inbound/Granger	15.3k	4
5. /Inbound/MPEG-Audio	13.7k	3
6. /Inbound/WinMedia	9774	2
7. /Inbound/IndianPlains/Default	8867	2
8. /Inbound/QuickTime	7324	2
9. /Inbound/MPEG-Video	7079	2
10. /Inbound/WhiteEagle	6493	2
All other classes	46.1k	12

period: 1-week, 21-May-2003 15:08 to 28-May-2003 15:08

In addition to the above graph, bandwidth utilization from the two feeder connections peeks at about 20Mbps. Currently, internet bandwidth utilization peeks at about 8Mbps, but the opinion of 204 network engineers is that this number is constrained by available bandwidth and would be closer to 10Mbps if sufficient bandwidth was available.

We have surveyed all the participants projected Internet Access Usage in the 2003-2004 year for this study. The bandwidth requirements of each participant and expected annual cost are detailed below.

Entity	Available Bandwidth	Peak Utilization	Current Cost/Yr	Forecast Bandwidth	Forecast Cost
City	1.5Mb	1Mb	$10,452.00	1Mb	$10,452
Library	3Mb	3Mb	.00	7Mb	$49,800
Park District	1.5mb	.5Mb	$11,306.40	.5Mb	$11,306
CUSD 203	45Mb	8Mb	$36,912.00	9.5Mb	$36,912
CUSD 204	9Mb	9Mb	$17,136.00	16Mb	$36,912
Total:	69Mb	21.5Mb	$75,806.40	34Mb	$145,382

Based on our conversations with the Illinois Century Network (ICN), we expect that the following cost structure will apply to the combined internet access bandwidth for all five entities.

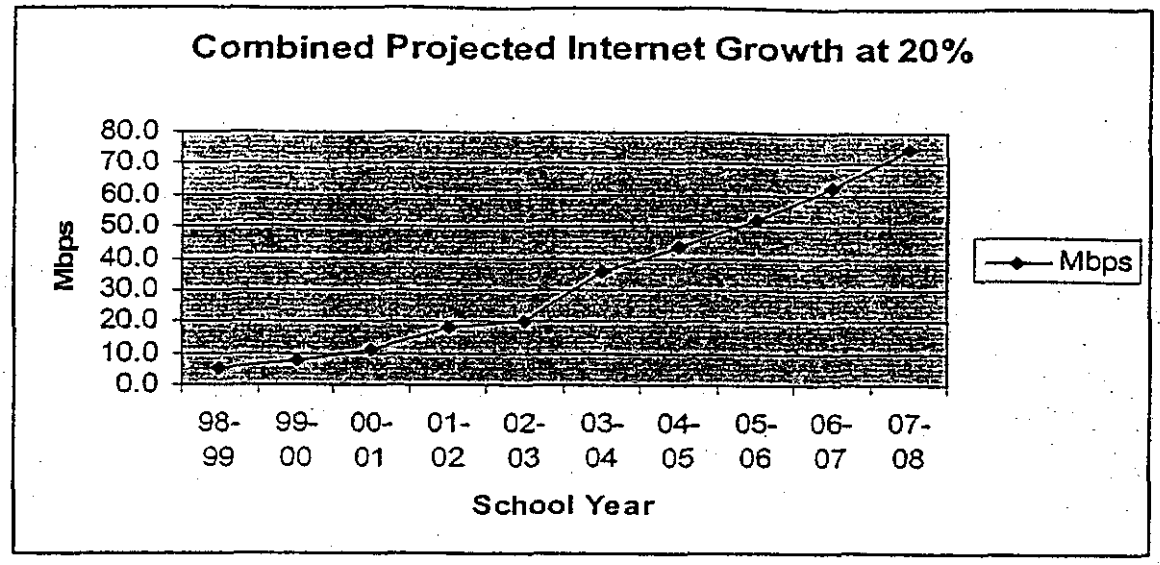
Entity	Available Bandwidth	Peak Utilization	Forecast Cost/Yr	Forecast Bandwidth	Forecast Cost
City	45Mb	1Mb	$10,452	1Mb	$3,936
Library	45Mb	3Mb	$49,800	7Mb	$3,936
Park District	45mb	.5Mb	$11,306	.5Mb	$3,936
CUSD 203	45Mb	8Mb	$36,912	9.5Mb	$36,912
CUSD 204	45Mb	9Mb	$36,912	16Mb	$0
Total:	45Mb	21.5Mb	$145,382	34Mb	$48,720

Based on the above, we expect the combined entities to save slightly less than $100,000 per year in internet access fees. Because of internet access bandwidth is purchased in large blocks, the exact savings from year to year will vary, but should average out to the $100,000 mark over time.

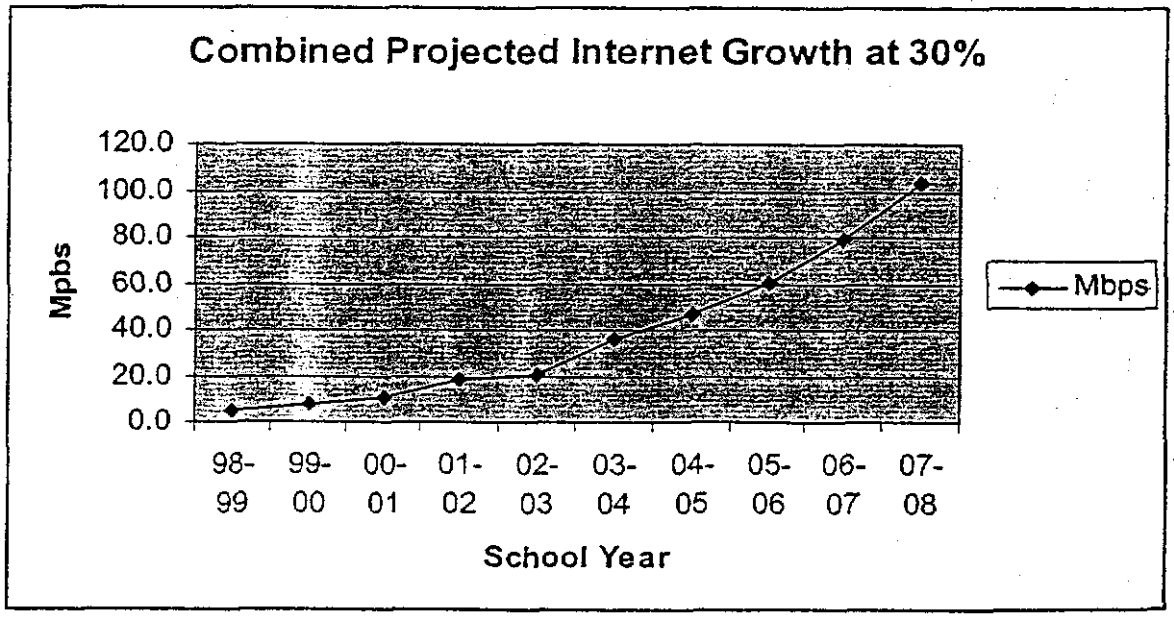
We would expect to allocate Internet Access Costs based on the percentage of bandwidth forecast to be used during the budget year. Using the above information, we could expect the cost savings to be distributed as follows:

Entity	Forecast Bandwidth	Bandwidth %	Original Cost Estimate	Forecast Cost	Original Cost Estimate	Forecast Cost Savings
City	1Mb	2.9%	$10,452	$5,021.65	$10,452	$5,430.35
Library	7Mb	20.6%	$49,800	$11,535.53	$49,800	$38,264.47
Park District	.5Mb	1.5%	$11,306	$4,478.82	$11,306	$6,827.18
CUSD 203	9.5Mb	27.9%	$36,912	$10,313.65	$36,912	$26,598.35
CUSD 204	16Mb	47.1%	$36,912	$17,370.35	$36,912	$19,541.65
Total:	34Mb		$145,382.00	$48,720.00	$145,382	$96,662.00

School district 203 has recently upgraded bandwidth from individuals T1 to a T3 (45 Mbps) and is currently using a peak of 9.5 Mbps. Internet usage growth at district 203 is expected to be 20% annually for the planning period. Although, we can not help but wonder whether the current network configuration naturally limits internet bandwidth utilization and growth for district 203. Combined growth of internet bandwidth utilization at 20% compounded annually is graphed below.



School district 204 is currently reaching a peak utilization of 8 Mbps of internet bandwidth. This is probably the maximum throughput possible given the 9 Mbps of available bandwidth. For the coming school year, internet access bandwidth consumption is expected to be approximately 16 Mbps. We developed a simple mathematical model to parallel district 204's internet access bandwidth consumption, our model shows that 204's internet access bandwidth needs basically double each year. We do not feel that this level of increase in bandwidth needs is supportable over the long term, therefore we feel that an increase of 30% or more, compounded annually is reasonable. Combined growth of internet bandwidth utilization at 30% compounded annually is graphed below



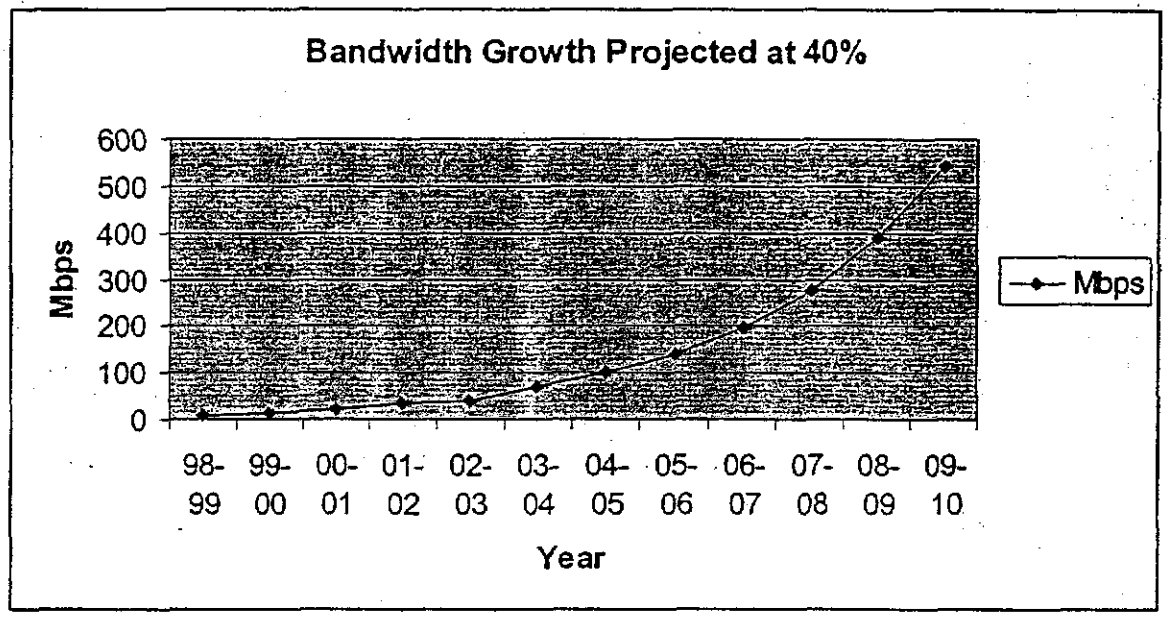
This graph leads us to forecast that, in a combined environment, a single T3 (45Mbps) will provide bandwidth through the 04-05 school year. A second T3 will be required for

the 05-06 school year. The two T3s will be sufficient through the 06-07 school year, when an OC3 will be required.

Overall Bandwidth

Using the ratio of 2Mbps of total bandwidth to 1Mbps of internet access bandwidth, we can "back into" a calculation of overall network bandwidth usage. Our projections are based on the fastest growing entities – school districts.

During the requirements gather phase, all participating entities expressed an interest in developing and implementing video conferencing capabilities. While we feel that the video industry has a strong interest in improving compression algorithms to limit bandwidth utilization, we have added 10% to the annual growth projection to accommodate video applications.



The above table shows that aggregate bandwidth will remain under 1 Gbps throughout the planning horizon.

We understand, because of the properties of ethernet and peak utilization, bandwidth utilization does not equate directly to bandwidth requirements. Therefore, we propose to double the available bandwidth at each aggregation point from 1 Gbps to 2 Gbps, and to implement a 10 Gbps redundant core network.

Network Alternatives

We investigated several network alternatives including SONET, Cisco Optical Networking and gigabit ethernet solutions. During our investigation, we used Cisco as the baseline for equipment and cost models. Our work with other clients leads us to believe that an open bid process that includes Cisco and other vendors would probably result in a project cost reduction of 20% or more from the estimates included in this report.

SONET

SONET (Synchronous Optical Network) provides high speed, fully redundant network transport in a ring configuration. SONET provides "five 9s" carrier class reliability and is often used by financial institutions and others that demand high performance and maximum reliability.

The cons to SONET are:

- Bandwidth comparable to gigabit ethernet is expensive (expect 3 to 4 times the price).
- Conversion to and from gigabit ethernet is can be cumbersome.
- Management and troubleshooting of SONET requires different management tools and highly qualified personnel.

We recently investigated SONET for an E911 dispatch center. Even in an E911 environment, the expense of SONET was not justified versus the simplicity and low cost of redundant gigabit ethernet paths. Therefore, we did not develop a specific SONET based cost model for this feasibility study.

Ethernet

We all understand the pros and cons of ethernet based solutions.

Pros:

- Inexpensive
- Simple to use and manage
- Ubiquitous
- Higher bandwidth alternatives available on a regular basis

Cons:

- Does not scale gracefully
- Throughput rates much less than bandwidth rating
- Slower to synchronize in the event of an outage

The "Pros" of ethernet base solutions outweigh the "Cons" for the Naperville Community Network project as they do in most projects that we undertake.

Collection Points

Because of the large distances that the five organizations covered, it quickly became apparent that designing a fiber network with redundant connections to each location would be cost prohibitive. In fact, other municipal fiber networks that we have designed utilize a star configuration, because creating a private fiber optic ring is a very expensive networking methodology. For this Study, we developed "collection points" for outlying locations and developed costs for single mode fiber and gigabit ethernet connections to the closest available collection point.

We chose "collection points" using two criteria:

1. "Collection points" are located on existing or planned City owned duct banks.
2. "Collection points" are located near several remote locations and their location reduces the cost of fiber optic cabling installation.

We then developed two specific fiber optic and network topologies based on the collection point method.

Core Triangle

We designed a ten gigabit core network triangle that connects Electric Service Center, Police and Fire Administration and Municipal Center and provides redundant connectivity to the main internet access point. The main advantages of this core triangle are:

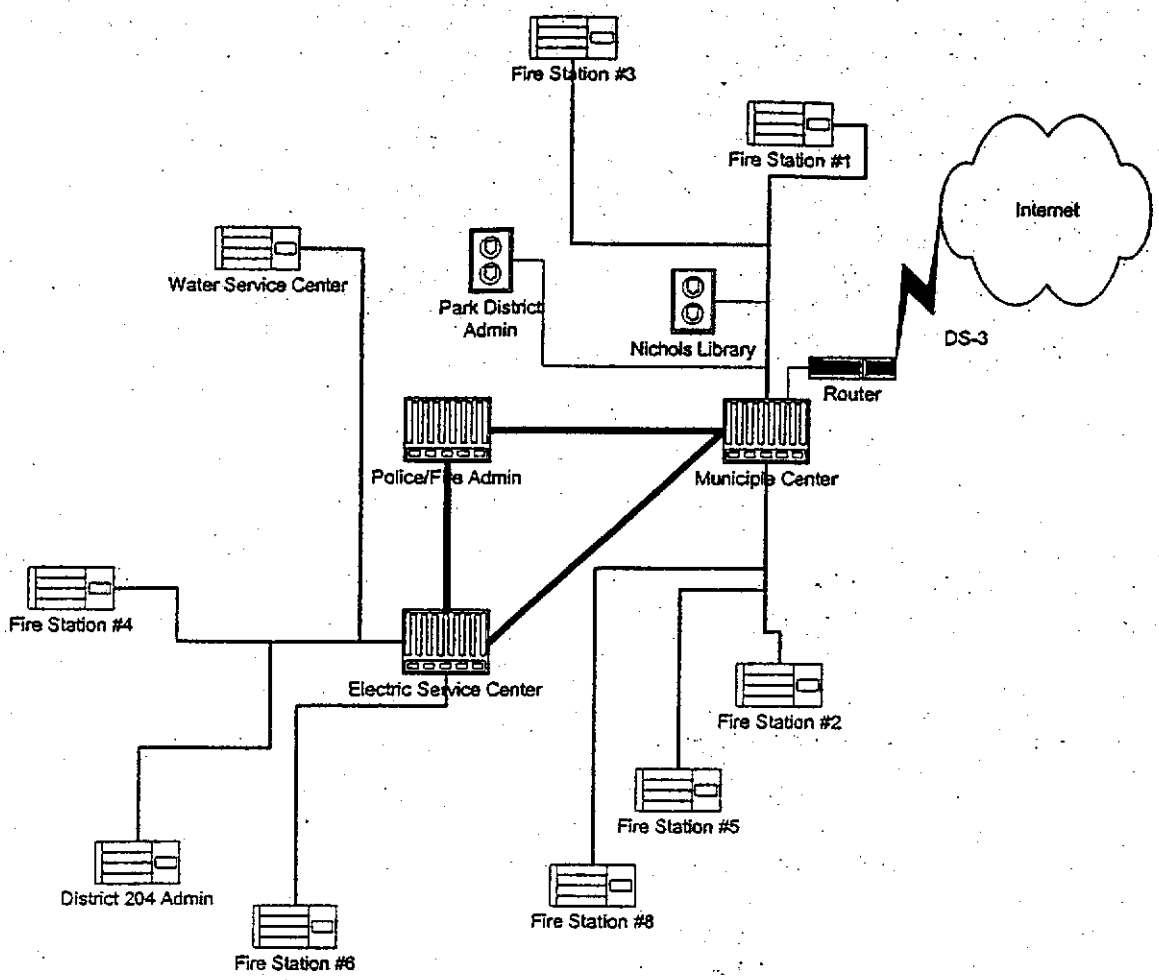
- Redundant paths to the internet access point.
- Flexibility to add redundant internet connections
- Limited additional cost

Star Topology

The basic configuration we developed as a part of the Study was a Star topology. Individual sites are connected using single mode fiber and gigabit ethernet to collection points, the collection points are then connected to the "core network" through two gigabit ethernet uplinks.

The primary advantages of this configuration over the following Ring configuration are:

- Reduced cost.
- Flexibility to increase bandwidth allocations on a collection point by collection point basis.

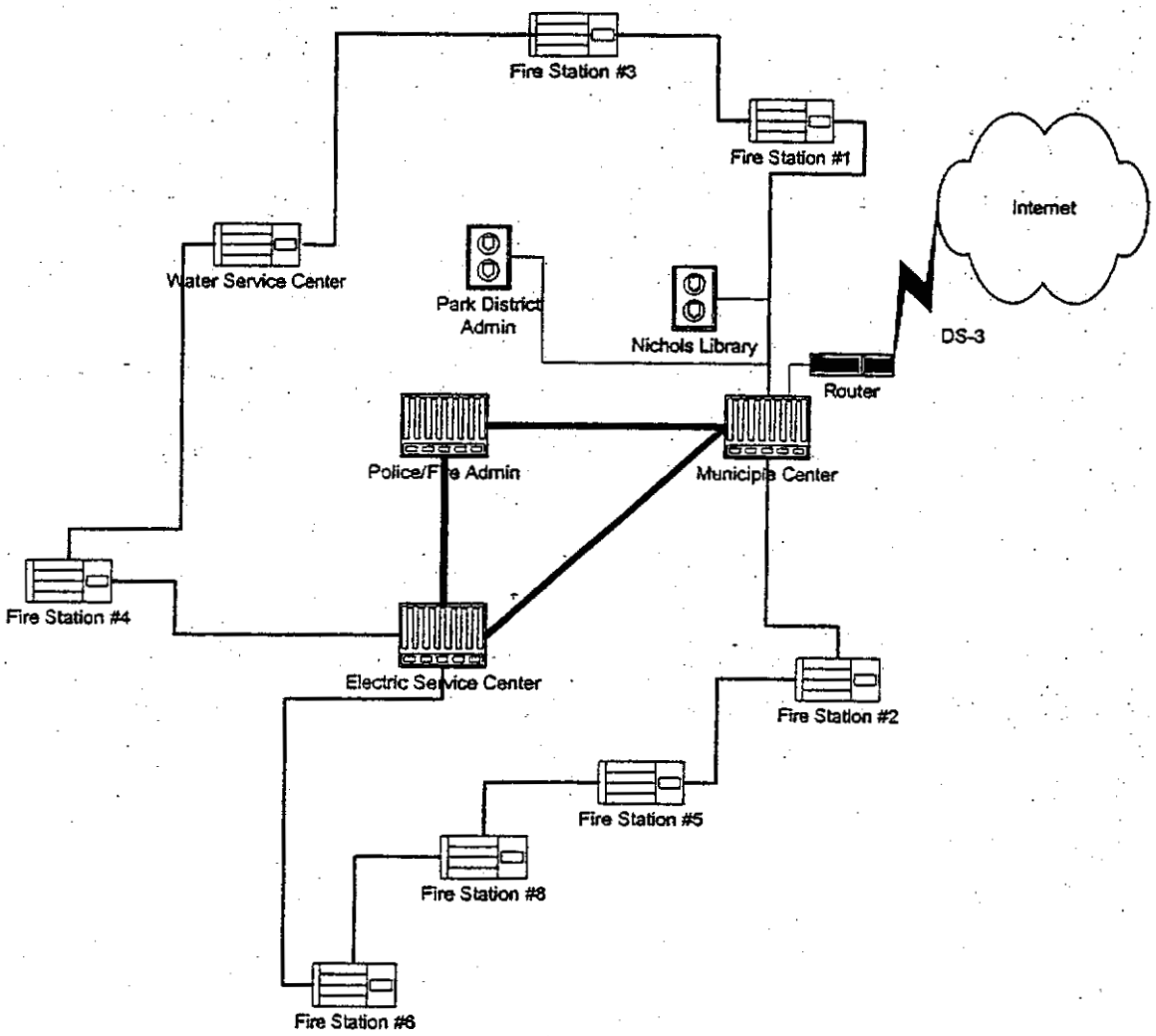


Naperville Community Network - Star

DEVELOPED BY: Technical Design Services, Inc.
DATE: 07/29

Ring Topology

The second configuration we developed is a Ring topology that was based on a previously developed City of Naperville design. This design provides additional bandwidth and redundancy for the various collection points. In the ring configuration, each collection point will be connected through two gigabit ethernet connections to two other sites.



Naperville Community Network - Ring

DEVELOPED BY: Technical Design Services, Inc.
DATE: 07/29

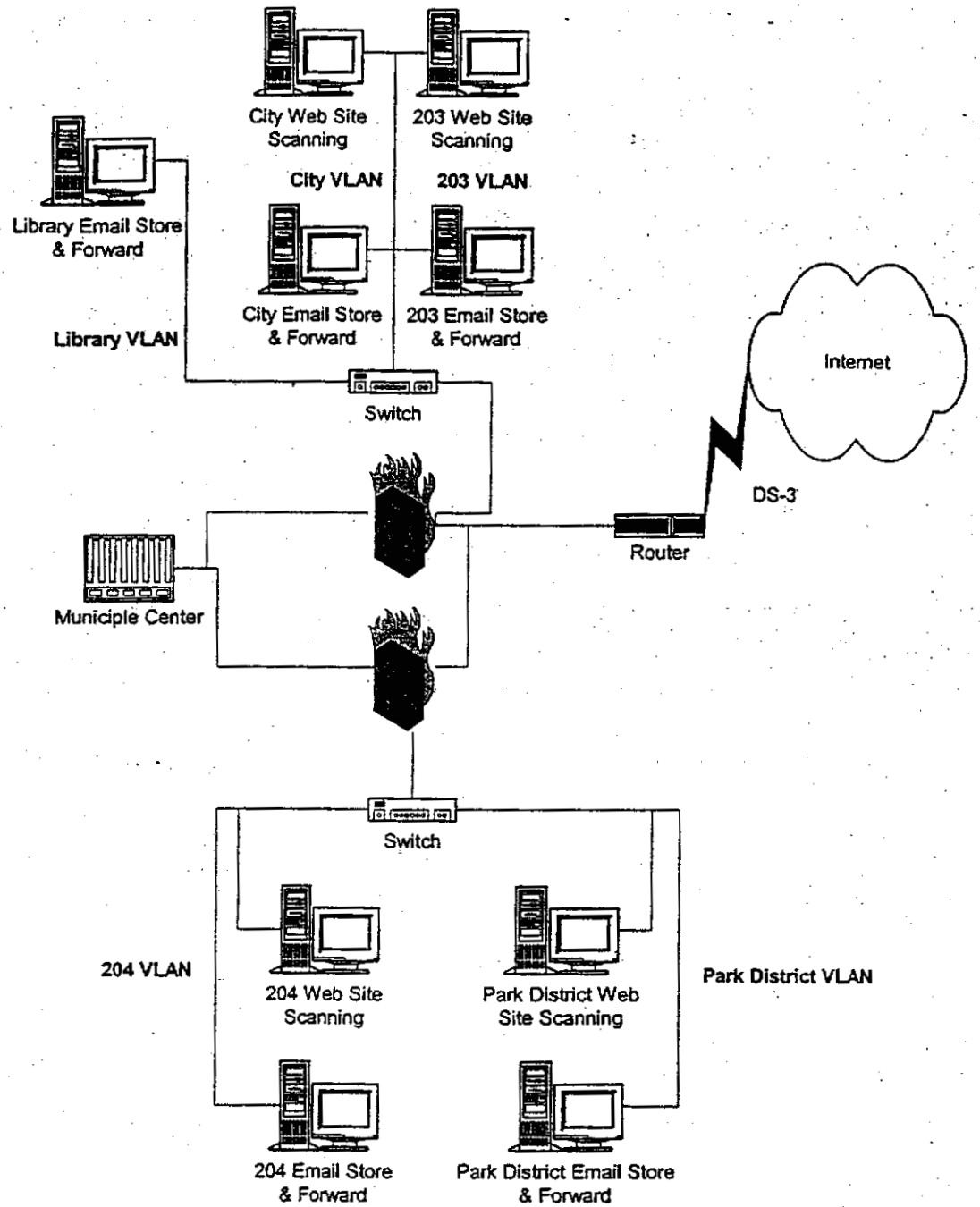
The primary advantages of this configuration of the Ring configuration are:

- Improved redundancy
- More bandwidth per site

Network Design Assumptions

For this Study, because of the diversity of equipment at each entity, we decided to provide each end node with a multiple single mode fiber patch locations. In other words, the subscriber organization is responsible for the electronics at each end node.

Each subscribing organization would be provided with a separate VLAN for all subscribing locations, meaning, while bandwidth would be shared by all locations, network traffic would be segregated in a secure manner by organization. This is especially important for controlling internet access, external electronic mail and any Web site screening that the organization may require. See the following internet connectivity diagram.



Creating separate and secure VLANs lead us to consider Layer 3 switches as a part of the cost estimates. The major advantage of utilizing Layer 3 switches in the design is the ability to route network traffic between nodes at each collection point, without necessarily traversing the network core. The ability to route network traffic will reduce the overall need for bandwidth and network latency. Based on these advantages, we have included the estimated cost of Layer 3 switches in the design.

We assumed that none of the participating organizations have the staff to design, procure, install or manage the fiber optic cable infrastructure or the data network. Therefore we included estimated fiber optic design, procurement and installation project

management consulting fees in the cost estimates. We also included network design, procurement and installation project management consulting fees plus two additional full time network managers for the installed network infrastructure.

Estimated Costs

For this Feasibility Study, we broke costs into the categories of:

- Fiber optic cabling costs
- Network equipment costs
- Annual costs
- Combined costs

Fiber Optic Cabling Costs

Fiber optic cabling costs can generally be allocated by organization, with each organization responsible for the expense of connecting their sites to the network. We have highlighted two separate cost items for additional network redundancy as options.

Entity	Description	Estimated Cost
City	Fiber optic cabling	$500,000
Park District	Fiber optic cabling	$417,000
Library	Fiber optic cabling	$71,000
CUSD 203	Fiber optic cabling	$1,050,000
CUSD 204	Fiber optic cabling	$2,270,000
Sub total:		$4,308,000
ALL (option)	Redundant route Electric Service Center & Municipal Center	$100,000
ALL (option)	Fiber optic ring	-$87,000
Total:		$4,321,000

The following sections summarize the methodology used to develop fiber optic cabling costs for the participants in the Study.

Fiber Optic Cabling Assumptions

All City of Naperville – Electric Department duct bank planned for installation through the 04/05 year will be in place before the installation of fiber optic cabling begins.

There are spare conduits in all of the duct banks that can be utilized for installation of fiber optic cabling.

All right-of–way permissions will be granted, without any major costs.

Where utility poles are available, we assumed that the City will be able to use the poles for fiber optic cabling.

Fiber Optic Cabling Design Considerations

The Municipal Center, Police Department and the Electric Service Center will be the core network. A redundant fiber optic connection will be installed from the Electric Service Center directly to the Municipal Center.

Network is designed based on a star topology from "collection points" which are either star or ring cabled to the core network. The ring topology will utilize existing Electric Department fiber optic cabling.

Each node will be connected to the collection points utilizing 24-strands of singlemode fiber optic cabling.

In a star topology, each collection point will be connected to the core network utilizing 24-strands of singlemode fiber optic cabling.

In a ring topology, the collection points will utilize four strands of the existing singlemode fiber optic cabling. The existing fiber optic cabling must be extended into each of the collection points.

The fiber optic cabling will be brought into each of the nodes and be terminated within a lockable, wall-mounted 24" cabinet.

The fiber optic cabling will be brought into each of the collection points and be terminated within an appropriately sized lockable cabinet(s) with adequate space for the fiber shelves and the network electronics.

Costs for fiber optic cable installation for Nichols Library, the Park District Administration Center and other sites to the north of the River are estimated based on installing cable to Fire Station #1. We feel fiber optic cabling costs for locations north of the river may be reduced if a direct connection to the municipal center is installed.

Fiber Optic Cabling Cost Estimates

Cost estimates for fiber optic cabling were developed using the following methodology:

Key buildings, including High Schools, Administration Centers and the Municipal Center were visited in order to understand possible fiber optic cabling issues and estimated distances and potential routing problems to network equipment rooms.

Our consultants worked with the City of Naperville Public Works – Electric to gain an understanding of:

- The existing duct bank system and including number of number of conduits per duct bank.
- The duct bank construction schedule.
- Preferred routes and distances from each facility to the duct bank system.
- Potential collection points and their pros and cons.
- In some cases, alternative routes were discussed in detail because of possible issues related to full conduits and limited access to pathways.
- Methods of avoiding routing fiber optic cabling directly through electric sub-stations.

We also worked with the City to determine what (if any) fiber optic cable might be available for this project and where that cable would be located.

The City had previously completed a preliminary study that estimated the cost of developing a data network to serve City and Library locations. We reviewed the findings of that Study and incorporated the ideas and cost estimates of that Study into the current Feasibility Study as appropriate.

To estimate fiber optic cabling costs, we developed a cost model that took into account all the key components of outside plant fiber optic cabling installation. These include:

- Cost estimates for directional boring, hand holds, fiber optic cabling and labor to pull and terminate the cable. If utility poles were available, costs associated with installation on the poles was included. Costs were developed based on current contractor cost estimates for similar work.
- Costs were estimated for fiber optic cabling for the distances from each facility to the duct bank system, including the cost of building terminations, the conversion to inside plant fiber optic cable, interduct and inside plant fiber optic cable and installation.
- Project management cost estimates and detailed design costs were also added to the final cost estimates in the Feasibility Study.
- Costs for termination patch panels and locking cabinets were included.

Using the same cost model, we also estimated the cost of fiber optic cable from the Collection Points to the core triangle network. As an option, we also estimated the cost of creating two fiber optic cabling rings between the collection sites. One ring would be for the northern collection sites and a second ring would be for the southern collection

sites. From a fiber optic cabling perspective, the ring approach is less expensive, because there is spare installed singlemode fiber that could be used for this application.

Data Networking Costs

Data networking costs were developed using the assumptions outlined above. Key components that are included in the cost structure are:

- Layer 3 switching
- Network management software
- Network administration
- Hardware and software maintenance
- Installation and project management costs
- High speed internet access and redundant firewalls

Network costs can since network equipment and transport is a shared resource, network costs can not be effectively allocated based on the location of the equipment. In addition, there are ongoing annual costs for equipment maintenance and support costs that must be considered.

Description	Estimated Cost
Total Network Costs (one time)	$989,000
Network Costs per Node (all nodes)	$12,200
Network Costs per Node (1 Park District)	$13,725
Total Annual Costs	$323,330
Monthly Cost per Node (all nodes)	$330
Monthly Cost per Node (1 Park District)	$375

The above costs lead us to the following table that describes costs for network electronics, installation and ongoing support by organization:

Entity	Number of Nodes	One Time Network Costs	Annual Network Costs	Current Annual Network Costs
City	13	$160,000	$52,000	$66,000
Park District	10	$122,000	$40,000	$11,424
Library	3	$37,000	$12,000	$13,512
CUSD 203	23	$281,000	$92,000	$96,000
CUSD 204	32	$390,000	$127,000	$17,000

Total:	81	$989,000	$323,000	$203,936

Based on bandwidth needs and annual network costs, we do not feel that the Park District would be justified in connecting all sites to the Community Network. The cost model shows that the Park District would benefit financially from a shared internet access arrangement. Also, the Park District and the City would benefit significantly from a high speed communications with the city for the exchange of GIS files and other information.

With a single park district connection, annual network costs change per the below table:

Entity	Number of Nodes	One Time Network Costs	Annual Network Costs	Current Annual Network Costs
City	13	$178,500	$58,250	$66,000
Park District	1	$13,500	$4,250	$11,424
Library	3	$41,500	$13,500	$13,512
CUSD 203	23	$316,000	$103,000	$96,000
CUSD 204	32	$439,500	$144,000	$17,000
Total:	72	$989,000	$323,000	$203,936

Combined Costs – Fiber Optics & Data Network

Based on the above costs, we assume that the Park District will connect a single node to the Community Network. This single gigabit connection will allow the park district shared internet access and to data sharing with the other Naperville Community Network organizations.

Combined one time costs for each organization are summarized below:

Entity	One Time Fiber Optic Cable Costs	One Time Network Costs	Total One Time Costs
City	$500,000	$178,500	$678,500
Park District	$34,250	$13,500	$47,750
Library	$71,000	$41,500	$112,500
CUSD 203	$1,050,000	$316,000	$1,366,000
CUSD 204	$2,270,000	$439,500	$2,709,500
Total:	$3,925,250	$989,000	$4,914,250

Projected annual costs are summarized below, these projected costs are for the 2004/2005 budget year. Internet access costs will increase over time, but it is assumed that cost ratios will remain approximately as forecast.

Entity	[illegible] Network Costs	[illegible] Internet Access Costs	[illegible] Total Network Costs	[illegible] Total Costs
City	$58,250	$5,000	$63,250	$76,500
Park District	$4,250	$4,500	$8,750	$11,500
Library	$13,500	$11,500	$25,000	$63,500
CUSD 203	$103,000	$10,500	$113,500	$133,000
CUSD 204	$144,000	$17,500	$161,500	$51,000
Total:	$323,000	$49,000	$372,000	$335,500

Using existing fiber based network proposals from the area, we calculated an average per node cost for high speed fiber based networks. These commercial proposals were all based on a ten (10) year contract. One was for an 18 site ATM network that would operate at 155Mbps, the other was for a 22 site ethernet network a 1Gbps to the two High Schools and the Administrative Center and 100 Mbps to all other schools. Neither of these proposals provide the same level of bandwidth or degree of flexibility that will be available in a Community owned and operated network.

A ten year cost comparison Naperville Community Network versus commercial purchase is included in the following table.

Entity	[illegible] Purchase Estimate	[illegible] Study Estimate	[illegible] Savings
City	$1,792,500	$1,261,000	$531,500
Park District	$138,000	$90,250	$47,750
Library	$413,500	$247,500	$166,000
CUSD 203	$3,171,000	$2,396,000	$775,000
CUSD 204	$4,412,000	$4,149,500	$262,500

Total estimated savings over the ten year life of the network would be in the range of $1,750,000. This number will vary based on the final network configuration and any upgrades that the participants implement during the ten year period.

Summary

This Feasibility Study clearly shows that there are significant financial advantages to creating a Naperville Community of governmental organizations with common interests. These organizations can then aggregate their voice and data networking requirements and drive down costs for services. In addition, leveraging the City's existing duct bank infrastructure to develop a high speed data network that can be used by the Naperville Community will be less expensive and more flexible than commercial offerings.

Over the near term, for voice services, it appears that negotiating an aggregate Centrex purchase with SBC will result in combined cost savings of over $300,000 for the City, Indian Prairie School District, Naperville Park District and Naperville School District.

Over the longer term, consideration should be given to leveraging any high speed data networking services to provide IP based telephony to the participating organizations.

The Study shows that leveraging the existing infrastructure to develop a high speed data network is less expensive than commercially available product offerings. We also feel that a Community Network that is operated by the organizations for there own benefit will be show greater flexibility in meeting the participants needs during the life of the network.

Creating a high speed data network that meets the expanding bandwidth requirements of the participating organizations will require time. The City of Naperville duct bank system that is a basic requirement for a cost effective network is not scheduled for completion until the 04/05 budget year. During the 04/05 budget year detailed planning for a high speed network could begin. We would expect that high speed services would not be available to the participating organizations until sometime in 2006 at the earliest. The Study shows that leveraging the existing infrastructure to develop a high speed data network is less expensive than commercially available product offerings.

Because of the savings that may be available from combined internet access, it may make sense to cross connect the existing networks for the purpose of providing high speed internet access to the participating organizations prior to an implementation of a Community Network.

We feel that an aggregate purchase of Centrex services until 2007 or 2008 will allow sufficient time for the construction and implementation of a data network that can then be leveraged to carry voice traffic, making IP Telephony or PBX based solutions much more cost effective.

PBX Advantages

- Features–A PBX will be specifically configured to the client. It offers the comprehensive set of features available and makes uniformity easier to accomplish.
- Networked PBXs would consist of multiple systems networked together to function as one. This provides level of "survivability". The loss of one system would not necessarily cause a failure in the others
- The costs of maintenance and hardware / software upgrades are included in the monthly cost of the Centrex, whereas with PBX service the systems need not to be upgraded unless the City desires a specific new feature when it is introduced.
- The bulk of the cost of PBXs is fixed when the equipment is initially installed; therefore its expense is easily budgeted. The only variable of major significance is the cost of possible feature enhancements and maintenance. Long-term contracts can be negotiated for fixed prices, and self-maintenance becomes an option.
- The cost of growth is reduced. The cost of additional stations at an existing location is greatly reduced. This allows the client to cost justify additional telephone sets at locations which may enhance employee productivity of public convenience.
- PBXs are is highly reliable. As mentioned above, they provide a level of redundancy and reliability.
- Networked PBXs allows the client to share its data communications network with its voice services. This provides higher-level network efficiency.
- PBXs allow for improved capability to implement software changes without the involvement of any other vendors. Software changes can be made on any of the systems from one location; this software is extremely user friendly, and easily accessible through the Internet.
- Perhaps the biggest advantage to PBXs is that it would require a major implementation, thus allowing the client an excellent opportunity to totally review the specific needs of each individual user on the system.

Disadvantages

- PBXs are a capital-intensive investment. If a significant new development occurred in the industry, it may require another major investment to replace the equipment. (No such breakthroughs are expected).
- The vendor selected primarily controls PBXs. If that vendor goes out of businesses, or chooses to no longer provide PBX service, the client may have obsolete equipment.
- Upgrades and software enhancements are totally controlled by the vendor selected. The city can request a feature or function be made available, but the client has no control over the disposition of the request.

- Ancillary systems are required to be interfaced to the PBXs to provide usage information. Basic call accounting, under the Centrex system, is included in the SBC billing.
- Reliance on bulk facilities. PBXs anticipated in this study would be served by bulk facilities. When a bulk facility goes down the effect is felt by many users.

Centrex Advantages

- Centrex is a single system. There is no requirement for software to simulate the "look and feel" of a single system – there is one system, Centrex.
- All costs of maintenance and hardware / software upgrades are included in the monthly cost of the Centrex.
- Cost of the Centrex is highly predictable. The only variable of major significance is the number of installed lines. Contracts can be long-term and at fixed prices.
- The cost of growth is absolutely linear. The cost of each additional station is defined in advance, and regardless of the additional software or common equipment required to provide the next station, the cost of each addition is the same.
- Centrex is highly reliable. Since the system is actually part of the SBC Central Office, it is provided the same extreme level of redundancy and reliability afforded the rest of the Public Switched Telephone Network (PSTN).
- Centrex does not require a network to link all of its locations. No T1s, no fiber optics, no network management are required – the network is inherent in Centrex.
- Recent changes to the Centrex have allowed for improved capability for the end user to implement software changes without the involvement of SBC. Centrex-mate service has been utilized by the city for some time, but the system has recently become more user friendly, and easily accessible through the Internet.
- Perhaps the biggest advantage to Centrex is that it requires no change. Implementing a new Centrex agreement with SBC would be as simple as a billing change.

Centrex Disadvantages

- Centrex is primarily analog service. While ISDN Centrex is available, and is currently utilized on a limited basis by the city, Centrex is primarily designed to function in an analog, simple single line telephone set, environment.
- Centrex is a rented service. Monthly charges extend through the life of a contract and monthly charges continue regardless of the length of time a line is installed.
- Centrex is primarily controlled by SBC. Enhancements, such as the recent improvement to the Centrex-mate capability, tend to occur at a slower pace than enhancements to competing services, and in a time frame under nearly the total control of SBC.

- Upgrades and software enhancements are totally controlled by SBC. The city can request a feature or function be made available, but the city has no control over the disposition of the request.
- Because it is primarily an analog service, Centrex does not integrate well with ancillary products such as voice mail and Automatic Call Distribution (ACD).
- Centrex provides limited information on calling usage by station. Ancillary systems can be interfaced to the Centrex, however, as noted above, these interfaces lack the capability available in competing services. Call accounting under the Centrex system is generally incomplete and lacking in timeliness.
- As with most technological enhancements, voice and data convergence is developing more slowly in the Centrex environment than in the PBX environment. IP Centrex products are developing but there is no widespread deployment of the technology.

VoIP Primary Providers

The primary manufacturers of VoIP systems include:

- 3Com
- Cisco
- Spheer Communications

In today's marketplace, all VoIP products, of all manufacturers, are sold through third-party distributors. These distributors vary in size, experience, and size of average customer. The distributor generally provides the direct customer interface services – design, installation and maintenance, both on-site component replacement and first-tier software support.

Comparison Table

The following table compares various features and functions of the three types of systems discussed above – Centrex, PBX and Internet Protocol Telephony. The comparison is not intended to be exhaustive, but rather to deal with basic features and functionality, particularly those issues most likely to be of concern to the city.

Feature	Centrex	PBX	Internet Protocol Telephony
Direct In Dialing	Yes	Yes	Yes
Analog Lines	Yes	Yes	Limited
Digital Lines	Limited	Yes	Yes
Analog Trunks	Yes	Yes	Limited
Digital Trunks	Yes	Yes	Yes
Centralized Voice Mail	Limited	Yes	Yes
Voice Mail Integration	No	Yes	Yes
Automatic Call Distribution	No	Yes	Yes
Call Accounting	No	Yes	Yes
Intercom Calling	Yes	Yes	Yes
Single System - Actual or Virtual	Yes	Yes	Yes
Functional Telephone Instruments	Limited	Yes	Yes
Effective Call Routing	Limited	Yes	Yes
High Reliability	Yes	Yes	Limited
Converged Voice & Data	Limited	Yes	Yes
Moves without Programming	No	No	Yes
Separate Cabling System Required	Yes	Yes	No
Unified Messaging	Limited	Yes	Yes
Computer Telephony Integration	Limited	Yes	Yes
E-911 Support	Yes	Yes	Limited

STATE OF ILLINOIS
ILLINOIS COMMERCE COMMISSION

CITY OF NAPERVILLE	)	
	)	
Application for Certificates of Service	)	
Authority to provide facilities-based and	)	Docket No. 03-0779
resold local exchange and interexchange	)	
telecommunications services, or in the	)	
Alternative, Request for Declaratory Ruling	)	
than no such Certificates are required for	)	
the City of Naperville to provide the	)	
Proposed facilities and services.	)	

CITY OF NAPERVILLE RESPONSES
TO FIRST SET OF DATA REQUESTS FROM
THE ILLINOIS TELECOMMUNICATIONS ASSOCIATION

DATA REQUEST

ITA 1.06 In Question #33 of Donald Carlsen's testimony, he states that the money to build the digital fiber optic system came from various sources. State the amount of money that came or will come from each of those sources.

Response: As stated in the Prepared Direct Testimony of Donald Carlsen in response to Question #33, "The money to build the system came from Electric Revenue Bonds and Electric Department Operating Revenues. Some of the network electronics were purchased with General Obligation Bonds." The actual flow of money as between Electric Revenue Bonds and Electric Department Operating Revenues was not tracked. All of the capital expenditures were recorded on the books of the Enterprise Fund for the City's electric utility. The network electronics that were funded from General Obligation Bonds were merely the customer premise equipment needed at the City's non-utility buildings, specifically routers at the police station, city hall, the public works building and six fire stations. The cost of these network electronics was approximately $300,000, and the remaining approximate $1,650,000 came from the Enterprise Fund for the City's electric utility.

Report on the

Electric Rate Study

prepared for the

City of Naperville
and the
Naperville Department of Public Utilities
Naperville, Illinois

2001
99-356-4

Burns & McDonnell
SINCE 1898

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April 19, 2001

Mr. Allan L. Poole, P.E., Director
Department of Public Utilities
City of Naperville
400 South Eagle Street
Naperville, IL 60566-7020

Naperville Department of Public Utilities
Electric Rate Study
Project No. 25141 (99-356-4)

Dear Mr. Poole:

Burns & McDonnell is pleased to present this report on the Electric Rate Study performed on behalf of the City of Naperville, Illinois (the City) and the Department of Public Utilities (Naperville). The report provides an explanation of the analysis performed to develop the allocated, unbundled cost of service for each of Naperville's electric rate classifications. It describes in detail the data, assumptions, and methodology used in completing the study.

The Electric Rate Study was developed based on the Electric Department's fiscal year 1999 financial results. Annual revenues and expenses were projected through fiscal year 2004 and three-year averages for fiscal years 2002 through 2004 were developed, resulting in the determination of the adjusted annual revenue requirement of $75,164,160. The components of the adjusted annual revenue requirement were unbundled to 12 separate functional services before being allocated to 12 rate classifications.

The study determined that the potential exists to decrease total revenues by approximately $6,386,879, or 7.8 percent. Revised rates were proposed that would generate revenues estimated to total $75,163,216.

The proposed rate structure would eliminate and combine several existing rate classifications where separate classes were no longer justified. In addition, a proposed pricing structure was developed for service provided to customers with cogeneration.

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We appreciate the opportunity to work with Naperville and its staff. We are grateful for the cooperation and assistance we received. Please call us with any questions or comments you may have regarding this report.

Sincerely,

David E. Christianson
Vice President

Brian D. Farber
Project Manager

Attachments

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APPENDIX B - TABLES (continued)

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EXECUTIVE SUMMARY

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INTRODUCTION

The City of Naperville, Illinois (the City) retained Burns & McDonnell Engineering Company (BMC) of Kansas City, Missouri, to prepare an Electric Rate Study for the electric utility of the Naperville Department of Public Utilities (Naperville). This report describes the electric cost-of-service analysis and retail rate design completed for Naperville.

Naperville's current electric rates were developed by BMC and documented in the Report on the Electric Cost-of-Service and Retail Rate Design Study, dated May 9, 1995. The rates designed in this 1995 study were implemented effective November 1, 1995. Since that time, Naperville's electric system load has increased substantially due not only to the rapid growth in the numbers of residential and small commercial customers, but also the significant additional loads of several large general service customers. In addition, the electric utility industry has continued to change significantly. In the future, Naperville will experience increased pressure from its customers to provide reliable electric service at competitive prices.

This Electric Rate Study was initiated by the City primarily to assess the potential impacts of the issues described above on Naperville's revenues and costs, its overall financial position, and its retail electric rates over the next several years.

Naperville's objectives for this rate study included:

- To update retail rates based on changing costs of providing service.
- To ensure full recovery of costs of providing service.
- To adopt current leading edge practices in design of rate alternatives.
- To build and improve upon the rate enhancements achieved with the last retail rate change implemented November 1, 1995.
- To consider the results of previous studies related to the rates charged to Lucent Technologies and to customers having cogeneration facilities.

Naperville and the City's Finance Department provided the information used in the preparation of this cost-of-service analysis and rate design study. This included various analyses, computer-generated information and reports, audited financial reports, and other financial and statistical information, as well as other documents such as power bills, debt service schedules, and current retail electric rate schedules.

Naperville also provided input to key assumptions regarding expected future levels of revenue, sales, and expenditures.

COST-OF-SERVICE ANALYSIS

BMC prepared an electric unbundled, allocated cost-of-service analysis for Naperville. This analysis resulted in comparisons of the revenue requirement allocated to each rate classification to the revenues provided by Naperville's current retail electric rates. The analysis was developed within BMC's Unbundle™ software, a proprietary cost-of-service model for electric utilities.

BMC developed the adjusted annual revenue requirement to be used as the basis for Naperville's allocated, unbundled cost-of-service analysis. This adjusted annual revenue requirement was determined by calculating three-year averages of projections for each of the various component revenues and expenses for Naperville's fiscal years (FY) 2002 through 2004. The adjusted annual revenue requirement and cost-of-service analysis were based on three-year averages of projected revenues and expenses for Naperville such that proposed retail electric rates resulting from this study should provide sufficient revenues for at least the next three years.

In the development of the projections of revenue and expenses for FY2002 through FY2004, BMC began with the financial operating results of Naperville for the fiscal year ended April 30, 1999 (FY1999). However, since the accounting records for Naperville are maintained in the City's governmental accounting system, the account structure and account numbers are not defined in accordance with the Uniform System of Accounts of the Federal Energy Regulatory Commission (FERC). As a result, in preparation for this rate study, the staff of the City's Finance Department spent a substantial amount of time translating the available detail account data for FY1999 to the FERC System of Accounts.

BMC believes that the current accounting software used by the City has the capacity and flexibility that would allow the FERC system of accounts to be implemented for the electric utility. Naperville should consider implementing additional project numbers for capturing operating and maintenance expenses on a functional basis. This would better support the unbundling analysis (discussed later in this section) of the annual revenue requirement and would facilitate more timely data collection for updates to the cost-of-service analysis for future rate studies. It also is becoming increasingly more important for Naperville to be able to analyze and better manage its costs, in detail, and to readily benchmark its operating performance against other utilities. BMC reiterates its recommendation that the City and Naperville give this issue serious consideration.

BMC developed projections for each of Naperville's revenues and expenses. For major items such as Rate Revenues, Other Operating Revenues, Cost of Purchased Power, Depreciation Expense, and Interest on Long-Term Debt, projections were developed for each fiscal year through FY2004 based on Naperville's load forecast, budget data, debt amortization schedule, and specific assumptions about future conditions. All other line items of revenue and expense were either held constant at FY1999 levels or were escalated at a compounded average rate of growth of 6.7 percent per year. BMC calculated this composite annual growth rate based on expense level changes anticipated in the FY2004 Budget as compared to the FY2001 Budget for the Administration, Support Services, Electrical Engineering, Distribution, and Supply and Control Divisions. The budget figures were obtained from the Five Year Financial Plan FY2001-2006 for the Electric Utility Fund. Net margins were determined based on a target interest coverage level of 3.00 (consistent with the financial performance target assumed in the 1995 study).

The adjusted annual cost of service consists of total operating expenses, including interest expenses, plus total net margins. The adjusted annual revenue requirement is equal to the annual cost of service minus other revenue. Naperville's adjusted annual revenue requirement was forecast to be $75,164,160. The projected annual electric rate revenue from the current rates was $81,551,039. Therefore, the analysis indicated the potential for a revenue decrease of $6,386,879, or 7.8 percent.

The adjusted annual revenue requirement was then unbundled by functional utility service. In analyzing the functional services Naperville currently provides to its utility customers, BMC and the Naperville staff identified 12 specific services in the categories of power supply, system control, transmission, distribution, customer service, and shared services.

The final adjusted amount for each detail account/element of other revenue, operating expense, net operating margins, and net non-operating margins were assigned to one or more of these unbundled services. The unbundled assignment of each amount was based on the utilization of specific data to estimate the portions of each item attributable to the various functional services. The adjusted amount for each item was assigned using one of the following approaches: direct assignment, assumed percentages, statistical factors, and composite ratios.

The manner in which each account/element was assigned among the functional services varied based on the nature of the account. BMC developed the proposed unbundling of the accounts/elements of Naperville's adjusted annual revenue requirement based on its understanding of the types of costs included in each account.

In general, the assignment of the adjusted annual revenue requirement for Naperville was based on an underlying premise that in a restructured electric utility environment, recovery of the costs of power supply would be somewhat at risk. If retail competition were to be implemented for Naperville, and an existing customer were to choose to purchase its power from a different supplier, the fixed costs associated with the sales lost would not be recovered. Therefore, certain costs were assigned only to the non-power supply functional services.

Following the unbundling of the various components of the adjusted annual revenue requirement to the functional utility services, the unbundled revenue requirement was further allocated to Naperville's retail rate classifications. These allocations were developed to reflect the relative impact each rate class has had on the level of each component.

Naperville currently bills its customers based on its electric rate schedules, which became effective November 1, 1995. Two rate schedules were later amended as of July 21, 1998. Naperville also provides electric service to three customers under separate individual contracts because they each own their own electric cogeneration equipment (Nalco Chemical, BP, and NICOR).

BMC utilized detailed billing history data for FY 1999 and projections of future sales and loads provided by Naperville to develop a series of allocation factors. Based on statistical billing determinants, estimates of the contributions of each rate classification to Naperville's total annual system energy requirements, power supply billing demand, and noncoincident distribution system demand were developed. In addition, the numbers of customers on Naperville's system in total and in each rate category were also determined. Ratios were calculated of each class's contribution for each statistic to the corresponding total. These ratios were identified as the allocation factors used to allocate each unbundled component of the adjusted annual revenue requirement to Naperville's rate classes.

Each component item of the adjusted annual revenue requirement was allocated to the appropriate customer classifications using the corresponding allocation factors. The allocated amounts were summarized for each rate class/customer, both in dollars and on a cents/kilowatt-hour (kWh) basis. Based

on the results of the allocation of the adjusted annual revenue requirement to the rate classifications and individual customers included in the cost-of-service analysis, Naperville determined that it was appropriate to combine several of the current classifications and customers analyzed into fewer groups.

The proposed changes to the rate classifications included:

- Combination of General Service Rate and General Service Electric Heating Rate classes
- Combination of Large General Service Rate, Educational Institution Rate, and Religious Institution Rate classes
- Combination of Government Rate and Municipal Rate classes

BMC also developed a forecast of Naperville's rate base in order to determine the effective return on rate base. Rate base includes net utility plant-in-service, plus working capital, minus deductions for funds held for others (which effectively reduce the total investment in the utility). It is a representation of the total net capital invested in the utility. The projected total adjusted rate base for the three-year period FY2002 through FY2004 was forecast to be $183,479,660. Once determined, the average rate base for the period through FY2004 was also unbundled and allocated in a manner similar to that of the adjusted annual revenue requirement.

The results of the cost-of-service analysis were broken down by rate classification into energy-related costs, expressed in dollars and cents/kWh; demand-related costs, expressed in dollars and dollars per kW of system power supply billing demand per month; and customer-related costs, expressed in dollars per customer per month. Also, the total cost of service was expressed in dollars and cents/kWh.

RATE DESIGN ANALYSIS

The unbundled, allocated cost-of-service analysis completed for Naperville by BMC served as input to the analysis and design of revised retail rates for Naperville's consideration.

The current rate structures for the Residential, General Service, Metered Outdoor Lighting, and Traffic Lighting Rates each include a monthly customer charge and a flat energy charge per kWh used. The Residential Electric Heating Rate includes a second energy block with a reduced rate for energy used over 800 kWh applicable for the months of October through May. The contract Outdoor Lighting Rate consists of flat monthly fees for each of various sizes of fixtures. The remaining rate schedules include monthly customer charges, flat demand charges applicable to maximum demand, and flat energy charges. The